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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/664,277	09/17/2003	Nicolay Y. Kovarsky	AMAT/7735/CMP/ECP/RKK	3455

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EXAMINER	
BIRENBAUM, NIRA S	
ART UNIT	**PAPER NUMBER**
1742	

DATE MAILED: 01/25/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/664,277	KOVARSKY ET AL.	
	Examiner	Art Unit	
	Nira S. Birenbaum, Ph.D.	1742	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11-14-05*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12 and 14-21* is/are pending in the application.

4a) Of the above claim(s) *18-21* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12 and 14-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Status of the Claims

Claims 1-12 and 14-17 are currently under examination. Claim 13 has been cancelled by Applicant. Claims 18-21 are withdrawn from consideration. The previous rejections of claims 1-12 and 14-17 have been withdrawn in light of the amendment and remarks filed on November 11, 2005. Please see new grounds of rejection below.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-12 and 14-17 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In independent claims 1 and 9, the limitation "wherein the electrode has an inner diameter greater than an outer diameter of a substrate being plated" is indefinite. Dependent claim 14, which claims a specific difference in size between the central electrode and the substrate, is also indefinite. In these claims, the size of the electrodes is defined relative to the size of the substrate to be plated, presumably a semiconductor wafer. However, semiconductor wafers are made in a variety of sizes, and the claims do not specify what size substrate is being used. It has been held that a claim which

refers to an object that is variable is indefinite. See Ex parte Brummer, 12 USPQ2d 1653 (Bd. Pat. App. & Inter. 1989).

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 5-7, 9, 12, 14, 16 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mayer *et al.* (US Patent No. 6,773,571) in view of Woodruff *et al.* (US Patent No. 6,916,412).

Regarding claim 1, Mayer *et al.* teach an electrochemical plating cell comprising:

- a fluid basin (**113**) configured to contain a plating solution (**115**)
- an anode fluid volume in the lower portion of the basin (anode chamber **131**) and a cathode fluid volume in the upper portion of the basin (the cathode is wafer **119**), separated by a membrane (**145**). (See Figure 9. Note that this figure depicts a detailed view of the anode chamber **131** and that the chamber is held within the fluid basin as shown in Figure 4. Thus the electrolyte in the fluid basin between the cathode and the membrane, which is not shown, would comprise the cathode fluid volume.)
- an electrode centrally positioned in the anode chamber (**125** in Figure 4, also present in Figure 9)
- an auxiliary electrode (deplating electrode) positioned radially outward from the first electrode (**127** in Figure 4, also present in Figure 9).

Mayer *et al.* do not expressly teach that the auxilliary electrode has an inner diameter greater than an outer diameter of the substrate. Woodruff *et al.* `412 teach an electrochemical processing chamber with concentric electrodes. The outermost electrode has an inner diameter which is larger than the outer diameter of the substrate (see figure 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus of Mayer *et al.* by using an electrode larger than the substrate as taught by Woodruff *et al.*, because Woodruff *et al.* teach that increasing the size of the electrodes prolongs the life of the electrode (column 17, lines 20-24).

Furthermore, the relative sizes of the electrode and the substrate depends on the diameter of the wafer (or other substrate) to be plated. Because semiconductor wafers come in varying sizes, the claim limitation would be met simply by using a wafer of smaller diameter than that of the electrode. For example, the electrochemical processing cell disclosed by Woodruff *et al.* `412 can be used to plate different size wafers (column 3, lines 44-65). Thus, the apparatus taught by Mayer *et al.* would meet the limitation that the inner diameter of the electrode be larger than the outer diameter of the substrate if an appropriately-sized substrate were used.

Regarding claim 5, Mayer *et al.* teach an insulative spacer between the electrodes (element **129**, see column 10 lines 26-27).

Regarding claims 6, 7, 16 and 17 Mayer teaches an electroplating cell as described in claim 1 above. Furthermore, Mayer teaches that the power supply (inherent in circuit **117**) is configured to individually address each electrode and provide

a different amount of current to each one (see column 3, lines 35-47; column 9 line 67 to column 10 line 2; and Figure 4). Mayer does not expressly teach that one electrode is cathodically biased and the other is anodically biased. However, the ability to have this configuration is inherent to the apparatus of Mayer, because Mayer teaches that the electrodes are individually addressable (*ie*, a different current is applied to each one). Furthermore, the limitation of biasing the electrodes with a certain polarity is directed to a manner of operating the apparatus, and does not provide any structural limitation. Therefore, these limitations are not given patentable weight. See MPEP 2114.

Regarding claim 9, Mayer teaches an electrochemical plating cell comprising

- an anolyte compartment (anode chamber **131**)
- a catholyte compartment in ionic communication with the anolyte compartment via a membrane (**145**). (See Figure 9. Note that this figure depicts a detailed view of the anode chamber **131** and that the chamber is held within the fluid basin as shown in Figure 4. Thus the electrolyte in the fluid basin between the cathode and the membrane, which is not shown, would comprise the catholyte compartment.)
- an anode positioned in the anolyte compartment (**125** in Figure 4, also present in Figure 9)
- an auxiliary electrode (deplating electrode) positioned in the anolyte compartment (**127** in Figure 4, also present in Figure 9).

Furthermore, Mayer *et al.* teach an electroplating cell wherein the central anode is a disk-shaped member with a substantially planar upper surface and the deplating electrode circumscribes the central anode (see Figure 4).

However, Mayer *et al.* do not teach the disk shaped anode in the same embodiment as the divided cell described above (this is the embodiment corresponding to figure 9 of Mayer, which shows an annular central anode). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate the disk-shaped electrode of Mayer's figure 4 in the divided cell of Mayer's figure 9, in order to increase the surface area of the electrode.

Mayer *et al.* also do not expressly teach that the auxilliary electrode has an inner diameter greater than an outer diameter of the substrate. Woodruff *et al.* `412 teach an electrochemical processing chamber with concentric electrodes. The outermost electrode has an inner diameter which is larger than the outer diameter of the substrate (see figure 4).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the apparatus of Mayer *et al.* by using an electrode larger than the substrate as taught by Woodruff *et al*, because Woodruff *et al.* teach that increasing the size of the electrodes prolongs the life of the electrode (column 17, lines 20-24).

Furthermore, and also in regards to claim 14, the relative sizes of the electrode and the substrate depends on the diameter of the wafer (or other substrate) to be plated. Because semiconductor wafers come in varying sizes, the claim limitation would be met simply by using a wafer of smaller diameter than that of the electrode, as outlined in the rejection of claim 1 above.

Regarding claim 12, the apparatus taught by Mayer *et al.* would inherently be constructed such that the upper surface of the deplating electrode would be vertically

movable relative to the upper surface of the anode. For example, the electrodes would be moved in this manner when being removed from the cell.

Claims 2-4, 8, 10-11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mayer *et al.* in view of Woodruff *et al.* `412, further in view of Woodruff *et al.* (US Patent No. 6,497,801).

Mayer *et al.* and Woodruff *et al.* `412 teach the features as previously described and applied to claims 1 and 9 above. Furthermore, Mayer *et al.* teach that the electrodes are made of high purity copper (column 10, lines 4-7). However, regarding claims 2, 3, 8 and 10, these references do not teach that the electrodes are insoluble platinum coated electrodes.

Woodruff *et al.* `801 teach an electroplating apparatus with multiple concentric anodes. The anodes are composed of titanium with a platinum coating (column 6, lines 3-5). It would have been obvious to one of ordinary skill in the art at time of the invention to modify the plating cell of Mayer *et al.* in view of Woodruff *et al.* `412 by replacing one or both of the copper anodes with insoluble platinum-coated anodes as taught by Woodruff *et al.* `801, in order to avoid the expense of replacing the consumable copper anodes as taught by Woodruff *et al.* `801 (column 5, line 66 to column 6, line 5).

Regarding claim 4, Mayer *et al.* teach that the auxiliary electrode is positioned to circumscribe the central inert anode and that they are in substantially the same plane (see Figure 5).

Regarding claim 11, Mayer *et al.* teach an electroplating cell wherein the central anode has a substantially planar upper surface and the auxiliary electrode is an annular member with a substantially planar upper surface (see Figure 4).

Regarding claim 15, Mayer teaches an insulative spacer positioned between the disk shaped electrode and the annular electrode (element **129**, see column 10 lines 26-27).

Response to Arguments

Applicant's arguments with respect to claims 1-18 have been considered but are moot in view of the new ground(s) of rejection.

Regarding applicant's argument that Mayer *et al.* do not teach an outer anode configured to be a deplating electrode, the term "deplating electrode" merely defines the manner of operating the apparatus and does not limit the structure of the electrode. Therefore, any electrode which is capable of being operated in that manner would meet the claim limitation.

Regarding applicant's argument that Mayer *et al.* teach away from a deplating electrode with an inner diameter greater than the outer diameter of the substrate, Meyer *et al.* disclose that the surface area of the electrodes should be a certain percentage of the surface area of the substrate. However, the total surface area of an annular electrode does not only depend on the diameter. One could construct an annular electrode with an inner diameter larger than the diameter of the substrate which still has a surface area smaller than that of the substrate. Furthermore, regarding Mayer's teaching that it is desirable to shield a circumferential edge of the plating area of the

substrate, this could also be accomplished using an electrode which is wider than the substrate. Mayer *et al.* teach the use of a shield, but there is no teaching or suggestion that would preclude the use of such a shield in conjunction with an electrode which is wider than the substrate. For example, Woodruff *et al.* `412 use an electrode which is wider than the substrate, and also incorporate shields to direct plating current to particular parts of the substrate (figure 4). These elements could be configured as to shield the circumferential edge of the substrate as taught by Mayer *et al.* Therefore, Mayer *et al.* do not teach away from a deplating electrode having an inner diameter greater than an outer diamater of the substrate.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nira S. Birenbaum, Ph.D. whose telephone number is (571) 272-8516. The examiner can normally be reached on M-F 8:00 am - 4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on (571) 272-1244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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